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(54) Recording medium for storing attribute information of a basic recording unit and method of identifying data using the attribute information

(57) A recording medium for storing attribute information on a basic recording unit and a method of identifying data using the attribute information are provided. On the recording medium, the attributes such as sector format, tracking method, reflectivity, area type, data type, and the number of layers of a sector, which is the basic recording unit of recordable and reproducible recording media, are stored. Especially, digital versatile disc-recordables (DVD-Rs), digital versatile disc-rewrtables (DVD-RWs) and digital versatile disc-random access memory (DVD-RAM) on which data can be

recorded and reproduced a multitude of times, information relating to the attributes of a sector which is a basic recording unit, in particular, information relating to data type, which represents whether the data is rewritable data, read-only, or linking data, can be stored in data identification data (DID) areas or identification data (ID) areas which is positioned at the fronts of the sectors for representing all information relating thereto. Accordingly, consistency among optical recording media of the DVD-type discs is maintained.

FIG. 2

b31 b24 b23								b0
SECTOR INFORMATION		SECTOR NUMBER						
b31	b30	b29	b28	b27	b26	b25	b24	
R	0:CLV FORMAT 1:ZONED FORMAT	0:PIR TRACKING 1:GROOVE TRACKING	0:>40% 1:<40%	0:RESERVED 1:LINKING DATA	0:DATA AREA 01:LEAD-IN 10:LEAD-OUT 11:MIDDLE AREA OF READ ONLY DISCS	0:READ-ONLY 1:RESERVED	0:LAYER 0 OF DUAL LAYER DISCS OR SINGLE LAYER DISKS 1:LAYER 1 OF DUAL LAYER DISCS	
					0:DATA AREA 01:LEAD-IN 10:LEAD-OUT 11:RESERVED	0:READ-ONLY 1:REWRITABLE		
				RESERVED				

Description

[0001] The present invention relates to an optical recording medium and more particularly, to a recording medium for storing attribute information on a sector, which is a basic recording unit, and a method of identifying the type of data using the attribute information.

[0002] In optical discs belonging to digital versatile disc (DVD)-type discs, a sector is the minimum division unit for data access ("basic recording unit"), and at the front of each sector, there is positioned an identification data (ID) area containing all information about (attributes of) the sector. This ID area corresponds to a data identification data (DID) area in digital versatile disc-random access memory (DVD-RAM). Specifically, identification information in the ID area, to which 4 bytes are assigned per sector, includes sector information and sector number as shown in Figure 1. The sector information contains sector format type, tracking method, reflectivity, linking type, area type, data type, and layer number.

[0003] The detailed structure of the currently prescribed sector information area of digital versatile disc-recordable (DVD-R) and digital versatile disc-rewritable (DVD-RW) will be described with reference to Figure 1. The sector format type of bit position b31 indicates whether the sector format is constant linear velocity (CLV) or zoned constant linear velocity (ZCLV) as follows:

- 0: CLV format type
- 1: Zoned format type

[0004] The tracking method of bit position b30 indicates whether the tracking method is pit tracking or groove tracking as follows:

- 0: Pit tracking
- 1: Groove tracking

[0005] The reflectivity of bit position b29 indicates whether the reflectivity is greater than, or less than or equal to 40% as follows:

- 0: greater than 40%
- 1: less than or equal to 40%

[0006] Bit position b28 is reserved.

[0007] The area type of bit positions b26 and b27 indicates whether the area is a data area, lead-in area, lead-out area, or the middle area of read-only discs as follows:

- 00: data area
- 01: lead-in area
- 10: lead-out area
- 11: middle area of read-only discs

[0008] The data type of bit position b25 denotes whether the data is read-only or linking data as follows:

- 0: Read-only data
- 1: Linking data

[0009] Finally, the layer number of bit position b24 denotes whether the layer number is of single or dual layer discs as follows:

- 0: Layer 0 of dual layer discs or single layer discs
- 1: Layer 1 of dual layer discs.

[0010] As shown in Figure 1, among the currently prescribed sector information of DVD-RAM, the sector format type of bit position b31, tracking method of bit position b30, reflectivity of bit position b29, reserved bit of b28, and layer number of bit position 24 are the same as the corresponding contents and bit positions defined in DVD-R/RW. Area and data types prescribed in DVD-RAM will follow. The area type of bit positions b27 and b26 indicates whether the area is a data area, lead-in area, lead-out area, or reserved area as given below:

- 25 00: data area
- 01: lead-in area
- 10: lead-out area
- 11: reserved

[0011] The data type of bit position b25 denotes whether the data is read-only or rewritable data as given below:

- 30 0: Read-only data
- 1: Rewritable

[0012] The structure of the ID area described above has the following problems. In the case of a DVD-RW, the basic physical format utilizes DVD-R standards, so that the data of each sector includes only read-only and linking data. DVD-RWs are remarkably different from DVD-Rs in that data can be erased and re-recorded numerous times. However, the ID area of DVD-RWs is not defined to indicate whether or not the type of data recorded on a basic recording unit is rewritable data. Therefore, a need for a method or area for indicating that a rewritable data is recorded on a sector comes to the front.

[0013] This means that a method of representing all three types of data stored on a DVD-RW -read-only, linking and rewritable- is basically required. Furthermore, a method of using another bit is also required because three types of data are not recordable with only 1 bit (See bit position b25 in Figure 1.) under the conventional standard. For the sake of the consistency of ID area structures that DVD-type discs have, the data type needs to be divided into practically usable data such as read-only and rewritable data, and otherwise such as

linking data.

[0014] With a view to solve or reduce the above problems, it is an aim of embodiments of the present invention to provide a recording medium for storing information which indicates data type as rewritable, read-only, or linking data on an identification data (ID) area where information relating to basic recording units is stored on a unit-by-unit basis.

[0015] It is another aim of embodiments to provide a recording medium for storing information about data type, which is classified into practically usable data such as read-only and rewritable data and non-practicallyusable data such as linking data, for the consistency of ID area structures which DVD-type discs have.

[0016] It is another aim to provide a recording medium on which data type may be indicated using attribute information stored in an ID area, for the consistency of ID structures which DVD-type discs have.

[0017] It is another aim to provide a method of identifying data using information about data type which is stored in an ID area which can store all information about basic recording units on a unit-by-unit basis and is classified into practically usable data such as read-only and rewritable data and non-practically usable data such as linking data.

[0018] It is another aim to provide a method of determining whether the data recorded on a basic recording unit is rewritable data, read-only data, or linking data, using attribute information stored in an ID area.

[0019] According to a first aspect of the present invention, there is provided a recording medium for storing information relating to the attributes of a basic recording unit in a predetermined area, wherein information representing the data type of data recorded on the basic recording unit as read-only, rewritable or linking data, is stored in the predetermined area.

[0020] According to a second aspect of the invention, there is provided a method of determining data recorded on a recording medium in which information on a basic recording unit is stored in a predetermined area, the method comprising the steps of: (a) reading out information relating to data type selected from attribute information stored in the predetermined area; and (b) determining whether data recorded on the basic recording unit is read-only, rewritable or linking data, based on the data type information.

[0021] Preferably, information representing the data type is stored by classifying the data type into a first data type, in a first case, and a second data type, in a second case , wherein the first data type comprises read-only and rewritable data, and the second data type comprises linking data.

[0022] In another aspect, there is provided a recording medium for storing a plurality of kinds of field information representing the attributes of a basic recording unit in a predetermined area, wherein the recording medium indicates whether data recorded on

the basic recording unit is read-only, rewritable, or linking data by combining two or more kinds of field information selected from the attribute information.

5 [0023] The predetermined area may be a data identification data (DID) area or an identification data (ID) area, and the relevant area is positioned at the front of the basic recording unit.

10 [0024] Preferably, the recording medium is one among the group consisting of digital versatile disc-rewritable (DVD-RW), digital versatile disc-recordable (DVD-R), digital versatile disc-random access memory (DVD-RAM), and digital versatile disc plus rewritable (DVD+ RW)

15 [0025] Preferably, data type information is stored within a sector information region of an identification data (ID) area using 2 bits.

20 [0026] Preferably, one of the bits represents a linking data and the other represents read-only or rewritable data.

25 [0027] Preferably, one of the bits represents rewritable data and the other represents read-only data or linking data.

30 [0028] Preferably, one of the bits represents linking data, and the other uses attribute information relating to reflectivity to represent read-only data or rewritable data.

35 [0029] The recording medium may indicate whether data recorded on a basic recording unit is read-only data or linking data by means of field information relating to data type stored as the attribute information, and indicates whether data recorded on a basic recording unit is rewritable data by means of two or more kinds of field information selected from the available field information which includes sector format type, tracking method, reflectivity, and area type.

40 [0030] Preferably, 2 bits are used within the sector information region of an identification data (ID) area which is positioned at the front of the basic recording unit, one of the bits representing linking data and the other representing read-only or rewritable data.

45 [0031] Preferably, 2 bits are used within the sector information area of an identification data (ID) area which is positioned at the front of the basic recording unit, one of the bits representing linking data, and the other representing read-only or rewritable data by using attribute information relating to reflectivity.

50 [0032] Preferably, 2 bits are used within the sector information region of an identification data (ID) area which is positioned at the front of the basic recording unit, one of the bits representing rewritable data and the other representing read-only or linking data.

55 [0033] In another aspect, there is provided a method of determining data recorded on a recording medium, in which a plurality of kinds of field information denoting various attributes of a basic recording unit is stored in a predetermined area, the method comprising the steps of: (a) combining a predetermined number of different kinds of field information; and (b) determining

whether the data recorded on a basic recording unit is read-only, rewritable, or linking data, based on the combined field information.

[0034] Preferably, in the step (b), it is determined that data recorded on the basic recording unit is one of read-only and linking data by means of field information relating to data type selected from the plurality of kinds of field information, and it is determined whether data recorded on a basic recording unit is rewritable data by means of two or more kinds of field information among the available field information which includes sector format type, tracking method, reflectivity, and area type.

[0035] For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings in which:

Figure 1 illustrates the configuration of a conventional identification data (ID) area of digital versatile disc (DVD)-type discs; and

Figure 2 illustrates the configuration of an ID area according to a preferred embodiment of the present invention.

[0036] As shown in Figure 1, in order to specify the data type of a sector, which is a basic recording unit, among the attributes of the sector, it is sufficient to simply indicate with bit position b25 the read-only and rewritable data in a digital versatile disc-random access memory (DVD-RAM) and the read-only and linking data in a digital versatile disc-recordable (DVD-R). However, the specification for a digital versatile disc-rewritable (DVD-RW) calls for a means of indicating rewritable data type.

[0037] Figure 2 shows the configuration of an identification data (ID) area for a DVD-R/RW/RAM according to one preferred embodiment of the present invention. In the case of a DVD-RW, to distinguish practically usable data such as rewritable and read-only data from linking data, a reserved bit b 28 is used as a linking data flag, indicative of linking data. If the bit b28 of a sector has the value "1", that indicates that the sector contains linking data. For the sake of conformity, D VD-R also uses bit b28 for indicating linking data among the data types as shown in Figure 2. In the case of a DVD-RAM, the conventional specification is applicable as shown in Figure 1. Therefore, in the case of a DVD-R, when linking data is indicated by the bit b28, in the case of DVD-R the presence of "0b" in bit b25 indicates read-only data, and the presence of "1b" in bit b25 indicates a reserved area. In the case of a DVD-RW, "0b" and "1b" in the bit b25 represent read-only and rewritable data, respectively.

[0038] According to another preferred embodiment of the present invention, for classifying data as either practically usable data such as read-only and rewritable

data, and non- practically-usable data such as linking data, linking data can be represented by means of bit b28, and read-only data and rewritable data can be distinguished from each other by means of the reflectivity of bit b29. Since the reflectivity of read-only data is about 60-70% and that of rewritable data is less than 30%, a drive can identify rewritable data by the reflectivity ratio. Thus, this may be described in the specification for the DVD-RW.

[0039] Meanwhile, according to one preferred embodiment of the present invention for representing rewritable data as well as read-only and linking data under the conventional ID structure shown in Figure 1, if rewritable data in a DVD-RW is further specified in reserved bit b28, all these types of data can be directly indicated by bits b28 and b25. According to another preferred embodiment of the present invention for representing rewritable data as well as read-only and linking data under the conventional ID structure, read-only and linking data are indicated by bit b25 according to the conventional standard, while a drive can determine whether or not data recorded on the present sector is rewritable data from the reflectivity, which can be described in the specification for the DVD-RW. The reflectivity, as described above, differs greatly depending on whether the data recorded on a sector is rewritable or read-only data.

[0040] According to yet another preferred embodiment of the present invention for representing a rewritable data as well as read-only and linking data under the conventional ID structure, rewritable data can be identified by combining two or more kinds of field information among the attribute information of an ID area. This means that since a drive already recognizes that the recording medium to be used is a DVD-R, a DVD RW or a DVD-RAM, in the case of a DVD-RW, the data type of a sector can be determined by combining area type and reflectivity, sector format type and reflectivity, or tracking method and area type.

[0041] Specifically, since only read-only data is recorded on lead-in and lead-out areas, and rewritable data is recorded only on a data area, a drive can determine whether or not data recorded on the sector is rewritable data through the combination of area type information with reflectivity information, which can only be described in the specification for the DVD-RW. Lead-in and lead-out areas have a constant linear velocity (CLV) format and a data area has a zoned format, so a drive can determine whether or not data recorded on the sector is rewritable data through the combination of sector format information with reflectivity information, which can only be described in the specification. Furthermore, since pit and groove tracking methods are applied to lead-in and lead-out areas, and data area, respectively, a drive may determine whether or not data recorded on the sector is rewritable data through the combination of tracking information with area type information, which can only be described in the specifica-

tion.

[0042] The present invention is not restricted to the case where two kinds of field information are combined among the attribute information of an ID area. There may be a combination of two or more kinds of field information. Moreover, the present invention can be applied to recording media such as DVD-Rs, DVD-RWs, DVD-RAMs, and DVD plus RWs (DVD+ RWs).

[0043] As described in the foregoing, embodiments of the present invention make it possible to determine all types of data by storing information relating to data type in such a way as to divide the data type into practically usable data such as read-only and rewritable data and non-practically-useable data such as linking data. Alternatively, all types of data can be determined by using two or more kinds of field information selected from sector information such as reflectivity, sector format type, area type, tracking method, and data type. According to embodiments of the present invention, therefore, even in the case of a DVD-RW rewritable data can be determined as well as read-only and linking data, which allows for consistency in the standards of DVD-type discs.

[0044] The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

[0045] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

[0046] Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

[0047] The invention is not restricted to the details of the foregoing embodiment(s). The invention extend to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. A recording medium for storing information relating to the attributes of a basic recording unit in a predetermined area, wherein information representing the data type of data recorded on the basic recording unit as one data type among the group consisting of read-only, rewritable and linking data, is

stored in the predetermined area.

2. A method of determining data recorded on a recording medium in which information on a basic recording unit is stored in a predetermined area, the method comprising the steps of:
 - (a) reading out information relating to data type selected from attribute information stored in the predetermined area; and
 - (b) determining whether data recorded on the basic recording unit is read-only, rewritable or linking data, based on the data type information.
3. The recording medium of claim 1 or the method of claim 2, wherein information representing the data type is stored by classifying the data type into a first data type, in a first case, and a second data type, in a second case, wherein the first data type comprises read-only and rewritable data, and the second data type comprises linking data.
4. A recording medium for storing a plurality of kinds of field information representing the attributes of a basic recording unit in a predetermined area, wherein the recording medium indicates whether data recorded on the basic recording unit is read-only, rewritable, or linking data by combining two or more kinds of field information selected from the attribute information.
5. The recording medium of claim 1, 3 or 4, wherein the predetermined area is a data identification data (DID) area or an identification data (ID) area, and the relevant area is positioned at the front of the basic recording unit.
6. The recording medium of claim 1, 3, 4 or 5, wherein the recording medium is one among the group consisting of digital versatile disc-rewritable (DVD-RW), digital versatile disc-recordable (DVD-R), digital versatile disc-random access memory (DVD-RAM), and digital versatile disc plus rewritable (DVD+ RW).
7. The recording medium of claim 1, wherein data type information is stored within a sector information region of an identification data (ID) area using 2 bits.
8. The recording medium of claim 7, wherein one of the bits represents a linking data and the other represents read-only or rewritable data.
9. The recording medium of claim 7, wherein one of the bits represents rewritable data and the other

- represents read-only data or linking data.
10. The recording medium of claim 7, wherein one of the bits represents linking data, and the other uses attribute information relating to reflectivity to represent read-only data or rewritable data. 5
11. The recording medium of claim 4, wherein the recording medium indicates whether data recorded on a basic recording unit is read-only data or linking data by means of field information relating to data type stored as the attribute information, and indicates whether data recorded on a basic recording unit is rewritable data by means of two or more kinds of field information selected from the available field information which includes sector format type, tracking method, reflectivity, and area type. 10
12. The method of claim 3, wherein 2 bits are used within the sector information region of an identification data (ID) area which is positioned at the front of the basic recording unit, one of the bits representing linking data and the other representing read-only or rewritable data. 15
13. The method of claim 3, wherein, 2 bits are used within the sector information area of an identification data (ID) area which is positioned at the front of the basic recording unit, one of the bits representing linking data, and the other representing read-only or rewritable data by using attribute information relating to reflectivity. 20
14. The method of claim 2, wherein, 2 bits are used within the sector information region of an identification data (ID) area which is positioned at the front of the basic recording unit, one of the bits representing rewritable data and the other representing read-only or linking data. 25
15. A method of determining data recorded on a recording medium, in which a plurality of kinds of field information denoting various attributes of a basic recording unit is stored in a predetermined area, the method comprising the steps of: 30
- (a) combining a predetermined number of different kinds of field information; and
 - (b) determining whether the data recorded on a basic recording unit is read-only, rewritable, or linking data, based on the combined field information. 35
16. The method of claim 15, wherein, in the step (b), it is determined that data recorded on the basic recording unit is one of read-only and linking data by means of field information relating to data type 40
- 45
- 50
- 55
- selected from the plurality of kinds of field information, and it is determined whether data recorded on a basic recording unit is rewritable data by means of two or more kinds of field information among the available field information which includes sector format type, tracking method, reflectivity, and area type.

FIG. 1 (PRIOR ART)

SECTOR INFORMATION		SECTOR NUMBER							
b31	b24 b23	b30	b29	b28	b27	b26	b25	b24	b0
R/RW	0:CLV FORMAT 1:ZONED FORMAT	0:PIT TRACKING 1:GROOVE TRACKING	REFLECTIVITY	RESERVED	AREA TYPE	DATA AREA 01:LEAD-IN 10:LEAD-OUT 11:MIDDLE AREA OF READ ONLY DISCS	DATA TYPE 0:READ-ONLY 1:LINKING DATA	LAYER NUMBER 0:LAYER 0 OF DUAL LAYER DISCS OR SINGLE LAYER DISKS 1:LAYER 1 OF DUAL LAYER DISCS	
RAM		0:>40% 1:<40%	RESERVED		00:DATA AREA 01:LEAD-IN 10:LEAD-OUT 11:RESERVED	00:DATA AREA 01:LEAD-IN 10:LEAD-OUT 11:RESERVED	0:READ-ONLY 1:REWRITABLE		

FIG. 2

SECTOR INFORMATION		SECTOR NUMBER									
b31	b24 b23	b31	b30	b29	b28	b27	b26	b25	b24	b0	
R											
RW	0:CCLV FORMAT 1:ZONED FORMAT	0:PIIT TRACKING 1:GROOVE TRACKING	0:>40% 1: \leq 40%	0:RESERVED 1:LINKING DATA	0:DATA AREA 01:LEAD-IN 10:LEAD-OUT 11:MIDDLE AREA OF READ ONLY DISCS	0:DATA TYPE 1 01:LEAD-IN 10:LEAD-OUT 11:RESERVED	0:READ-ONLY 1:RESERVED	0:DATA TYPE 1 01:LEAD-IN 10:LEAD-OUT 11:RESERVED	0:READ-ONLY 1:REWRITABLE	0:AYER 0 OF DUAL LAYER DISCS OR SINGLE LAYER DISKS 1:AYER 1 OF DUAL LAYER DISCS	
RAM											